

August 30, 2013

VIA WEB SUBMISSION
& E-MAIL

Mr. Nicholas Oros
Office of Engineering and Technology
Federal Communications Commission
445 12th St., SW
Washington, D.C. 20554

Re: Space Exploration Technologies Corp. Comment, Federal Communication Commission Proposed Rule: Federal Earth Stations—Non-Federal Fixed Satellite Service Space Stations; Spectrum for Non-Federal Space Launch Operations, Docket No. 13-115

Dear Mr. Oros:

Space Exploration Technologies Corp. (“SpaceX”) is pleased to comment in response to the Federal Communications Commission (“Commission”) Office of Engineering and Technology (“OET”) Proposed Rule: Federal Earth Stations—Non-Federal Fixed Satellite Service Space Stations; Spectrum for Non-Federal Space Launch Operations.¹

SpaceX, the world’s fastest growing launch services company, was founded by Elon Musk in 2002 to dramatically improve the reliability, safety, and affordability of space transportation. Since its inception, SpaceX has focused on launch vehicles, spacecraft, ground systems and mission systems meant to enable safe, reliable, routine and affordable launches to orbit. The SpaceX Falcon 9 provides medium-lift launch capability, and the Falcon Heavy is an intermediate- to heavy-lift launch vehicle. SpaceX also manufactures and operates the Dragon spacecraft, currently in operational use to resupply the International Space Station (“ISS”), and which is being modified to safely transport astronauts to the ISS under development agreements with NASA. SpaceX’s current launch manifest includes commercial and government customers, both international and domestic. All of our launches to date – whether for commercial or government customers – have required commercial launch licenses and radio frequency licensing. The company’s substantial and growing business of executing commercial launches in the coming years will require ever greater radio frequency licensing, as will the needs of other domestic launch services providers as they expand their launch portfolios. We appreciate the FCC undertaking this rulemaking process in recognition of the need to provide a predictable regulatory framework for the allocation of spectrum in this area.

The Notice of Proposed Rulemaking (“NPRM”) proposes alternatives to modify the Table of Frequency Allocations (“Allocation Table”) to provide access to spectrum on an interference-protected basis to FCC

¹ 78 Fed. Reg. 39200-232.

licensees for use during space launch operations. The NPRM makes additional proposals designed to “facilitate” the continued growth of the commercial space launch industry. The Commission has stated its intention in the NPRM, consistent with the National Space Policy² and the National Space Transportation Policy,³ to “advance the commercial space industry and the important role it will play in our nation’s economy and technological innovation now and in the future.”⁴ The Commission also notes in its Notice of Inquiry (“NOI”) that it seeks recommendations on “ways to ensure the long term sustainability of the commercial launch industry by exploring other alternatives to use of these bands as more commercial launches are conducted and more private spaceports are established.”⁵ SpaceX offers the following comments, which seek to be responsive to specific questions and proposals in the Commission’s NPRM. Separately, SpaceX offers additional views to facilitate the Commission’s timely and prudent regulatory planning with respect to the growing commercial space industry.

Broadly, SpaceX’s position on the major points of the Commission’s proposed regulatory changes are below. However, our detailed comments suggest modifications in several areas to better support industry spectrum requirements:

- (1) SpaceX supports the Commission’s first Alternative to amend the Allocation Table by adding a footnote establishing co-primary allocation status for Federal and non-Federal users in specific portions of the 2200-2290 MHz band for launch telemetry and video. Here, SpaceX supports the Commission’s proposed allocation of spectrum for commercial space launch operations on a non-interference basis. However, SpaceX has two recommendations to enhance this proposal, as outlined in Section III.
- (2) SpaceX supports the Commission’s proposal to make a co-primary non-Federal aeronautical mobile allocation for the 420-430 MHz band for use for self-destruct signals during commercial launches.
- (3) SpaceX does not support the Commission’s proposal to utilize three frequencies in the 2360-2396 MHz band for commercial space launch operations as an alternative to allocating portions of the 2200-2290 MHz band for such operations.
- (4) SpaceX has no position on the Commission’s proposals related to the 5650-5925 MHz Band.

I. SpaceX’s Commercial Market: Current and Future Spectrum Requirements

Operational Requirements

SpaceX provides launch services to NASA, the U.S. Department of Defense, and a wide portfolio of commercial and international government customers. SpaceX has design and manufacturing facilities in Hawthorne, CA; a state-of-the-art Rocket Development Facility in McGregor, TX; launch sites at Cape Canaveral Air Force Station (“CCAFS”) and Vandenberg Air Force Base (“VAFB”); and offices in Houston, TX, Chantilly, VA, and Washington, DC. SpaceX is also leasing land at Spaceport America in

² National Space Policy of the United States of America. June 28, 2010.

³ National Space Transportation Policy. NSPD-40. January 6, 2005.

⁴ NPRM at 39200.

⁵ NPRM at 39201-202.

New Mexico for a series of upcoming flights for the Grasshopper Vertical Takeoff Vertical Landing (“VTVL”) research and development program. In addition to our existing launch sites at East and West coast Federal ranges, SpaceX is in the process of developing the first fully-commercial launch site. SpaceX employs over 3,000 people and maintains a supply chain network of more than 1,500 vendors nationwide.

SpaceX to date has successfully executed five Falcon 9 launches, and berthed the Dragon spacecraft with the ISS three times. In addition, the company has started the integration process for multiple manifested missions for national and international commercial and government customers, including three upcoming commercial flights for McDonnell Dettwiler & Associates (MDA), SES, and Thaicom by the end of this calendar year. SpaceX currently has over 50 missions on its manifest through 2018, with a total contract value of nearly \$5 billion. The majority of these missions are for non-U.S. Government customers.

The Commission states that it is undertaking the Proposed Rule due to its belief that “this action is necessary to support the forecasted increase in the number of commercial space launches in the future,”⁶ and specifically seeks comments on these views. SpaceX strongly concurs with the Commission’s assessment. As demonstrated by our manifest (Table 1), SpaceX is restoring commercial launch market share to the U.S. and executing many Government flights under commercial licenses. Further, SpaceX encourages the Commission to review FAA’s annual commercial space launch forecast, which further validates the Commission’s assessment.⁷

SpaceX currently has agreements with NASA for Falcon launch services carrying cargo to the International Space Station with the NASA Cargo Resupply Services (“CRS”) contract and for the development of human spaceflight capabilities under the NASA Commercial Crew Program. Separately, SpaceX is a launch services provider for NASA science missions under the NASA Launch Services II (“NLS-II”) IDIQ contract. Under NLS-II, SpaceX has contracted with NASA to conduct the launch of the Jason-3 satellite in 2015...

Under the CRS contract, SpaceX is providing regular operational resupply services to and from the ISS using its Falcon 9 launch vehicle with the Dragon spacecraft. Besides scientific payloads, the resupply missions carry life-sustaining food and equipment to astronauts aboard the ISS. These CRS missions involve consistent complex missions to low Earth orbit, and SpaceX is expected to deliver a minimum of 20,000 kg to the Space Station. Following a successful demonstration of cargo resupply capability under the Commercial Orbital Transportation Services (“COTS”) program, to date SpaceX has performed 2 operational flights for NASA under CRS, with another 10 operational missions remaining through 2015. The Commission has played an important role in these launches to date and is a significant ongoing federal partner to SpaceX and NASA as these critical flights are performed.

Importantly, SpaceX has substantial commercial business and has successfully captured a large portion of the launch market share with nearly 40 *commercial* launches on the current manifest through 2018 (Table 1). SpaceX’s ability to out-compete the French, Russians and Chinese and bring international launch business back to the United States is a significant victory for the United States as a whole and helps to achieve the core goals of the National Space Policy. It bears noting that, at this time, SpaceX is the only U.S. launch services provider that is competitive in the global space launch marketplace.

⁶ NPRM at 39207.

⁷ Federal Aviation Administration. 2013 Commercial Space Transportation Forecast. FAA Commercial Space Transportation (AST) and the Commercial Space Transportation Advisory Committee (COMSTAC). May 2013.

Table 1: SpaceX manifest supports national and international government and commercial customers

Customer	Target Date*	Vehicle	Launch Site
MDA Corp. (Canada)	2013	Falcon 9	Vandenberg
SES (Europe)	2013	Falcon 9	Cape Canaveral
Thaicom (Thailand)	2013	Falcon 9	Cape Canaveral
ORBCOMM – multiple flights	2013-14	Multiple	Cape Canaveral
NASA: Resupply to ISS – Flight 3	2014	F9/Dragon	Cape Canaveral
Falcon Heavy Demo Flight	2014	Falcon Heavy	Vandenberg
AsiaSat	2014	Falcon 9	Cape Canaveral
AsiaSat	2014	Falcon 9	Cape Canaveral
NASA: Resupply to ISS – Flight 4	2014	F9/Dragon	Cape Canaveral
NASA: Resupply to ISS – Flight 5	2014	F9/Dragon	Cape Canaveral
NASA: Resupply to ISS – Flight 6	2014	F9/Dragon	Cape Canaveral
Space Systems/Loral	2014	Falcon 9	Cape Canaveral
Thales Alenia Space/Turkmenistan	2014	Falcon 9	Cape Canaveral
US Air Force: DSCOVR	2014	Falcon 9	Cape Canaveral
CONAE (Argentina)	2014	Falcon 9	Vandenberg
ABS/Satmex	2014	Falcon 9	Cape Canaveral
NASA: Resupply to ISS – Flight 7	2015	F9/Dragon	Cape Canaveral
NASA Launch Services: Jason-3	2015	Falcon 9	Vandenberg
Spacecom (Israel): AMOS-6	2015	Falcon 9	Cape Canaveral
NASA: Resupply to ISS – Flight 8	2015	F9/Dragon	Cape Canaveral
NASA: Resupply to ISS – Flight 9	2015	F9/Dragon	Cape Canaveral
US Air Force: STP-2	2015	Falcon Heavy	Cape Canaveral
NSPO (Taiwan)	2015	Falcon 9	Vandenberg
Bigelow Aerospace	2015	Falcon 9	Cape Canaveral
SES (Europe) (multiple launches)	2015	Falcon 9	Cape Canaveral
CONAE (Argentina)	2015	Falcon 9	Vandenberg
ABS/Satmex	2015	Falcon 9	Cape Canaveral
NASA: Resupply to ISS – Flight 10	2015	F9/Dragon	Cape Canaveral
NASA: Resupply to ISS – Flight 11	2016	F9/Dragon	Cape Canaveral
NASA: Resupply to ISS – Flight 12	2016	F9/Dragon	Cape Canaveral
DragonLab Mission 1	2016	F9/Dragon	Cape Canaveral

Research & Development Requirements

In addition to performing launches already under contract (as well as pursuing additional launch opportunities in the out-years), SpaceX is committed to cutting-edge research and development. At present, SpaceX is privately funding innovations that will result in groundbreaking reductions in the cost of space access. These activities already require radio frequency licensing by the Commission today and—if proven successful—will have significant implications for future regulatory requirements. For instance, SpaceX's Grasshopper research and development project is focused on developing fully and rapidly reusable rockets, products that will transform space exploration by radically reducing its

cost. Grasshopper is SpaceX's vertical and takeoff and landing (VTVL) vehicle. With Grasshopper, SpaceX engineers are testing the technology that would enable a launched rocket to return to Earth and land intact, rather than having spent stages burn up upon reentry into the Earth's atmosphere.

SpaceX began flight testing Grasshopper in September 2012 with a brief, 3-second test "hop" at its rocket development facility in McGregor, Texas. That flight has been followed by a series of progressively higher flights against a rigorous set of testing objectives. For each of these flights, SpaceX has worked with the Commission to obtain experimental frequency authorizations needed to conduct the test. At this time, the low-altitude testing objectives are complete, and SpaceX is moving to the next steps in the program. A second larger and more capable Grasshopper test vehicle is being built for testing at higher altitudes and supersonic speeds. In May 2013, SpaceX announced that the higher altitude, higher velocity aspects of the Grasshopper flight test program will be done at Spaceport America, near Las Cruces, New Mexico, and signed a 3-year lease for land and facilities at the spaceport. In order for SpaceX to successfully execute these tests and advance the state-of-the-art in rocket technology, the company will continue to require timely approval of spectrum allocation from the Commission under experimental permitting rules.

To that end, SpaceX recommends that the Commission consider adding developmental commercial launch testing to approved co-primary uses for non-Federal users in the 2200-2290 MHz band. The Commission's proposal would otherwise limit non-Federal use on this band "for space launches to pre-launch testing and for launches conducted from Federal ranges."⁸ The Commission seeks comment on whether such limitations would "unduly limit the future growth of the space launch industry."⁹ In short, both limitations would unduly limit the growth of the industry.

Because it is engaged in developmental testing designed to achieve reusable launch systems based on existing launch vehicle architecture,¹⁰ SpaceX requests that the Commission provide for developmental testing using the identified portions of the 2200-2290 MHz band, and allow co-primary allocation from FAA-licensed spaceports in addition to Federal ranges. Such developmental testing at Federal ranges is much more difficult for various reasons, including conflicts with high-priority national launch needs. Enabling commercial companies to design next-generation launch vehicles with radios using frequencies that will be used for subsequent flights will materially reduce costs and streamline the coordination process—both for launch and testing. Such testing is relatively infrequent and will occur from only a few discreet locations, limiting any potential for interference.

II. Current Licensing Approach

This Commission's NPRM is timely given the robust growth of the commercial space launch industry in the U.S., which necessitates the development of a streamlined, predictable spectrum licensing process to ensure the continued growth of the industry and the effective, efficient, and prudent use of the radio spectrum. SpaceX currently conducts commercially licensed launches for both NASA and its commercial customers pursuant to Federal Aviation Administration ("FAA") licenses. The regulations in this area are driven by the mandates of the Commercial Space Launch Act ("CSLA").¹¹ As a result of being a

⁸ NPRM at 23209.

⁹ NPRM at 23209.

¹⁰ The Grasshopper test article is essentially the first stage of a Falcon 9 launch vehicle with a single Merlin 1D engine; future iterations of the test article will include additional propulsion.

¹¹ Public Law 108-492.

commercially-licensed space launch operator, the FCC is SpaceX's primary regulator with respect to the allocation of spectrum. As a result, SpaceX has significant experience in working with the Commission in obtaining Special Temporary Authorizations ("STA") that enable the company to perform its contracted operations for the U.S. Government and non-U.S. Government customers. SpaceX appreciates the Commission's work in successfully coordinating and approving the allocation of spectrum for multiple flights of the Falcon launch vehicles and Dragon operations to date.

As the Commission notes in its NPRM, the current licensing approach is executed under Part 5 experimental licensing rules through the STA process on a per-mission basis. Each STA is accompanied by "special conditions;" is valid for a maximum of six months; and is approved on a non-interference basis. To ensure timely approval, SpaceX must work to pre-coordinate its proposed spectrum usage with interested federal agencies, such as NASA and the U.S. Air Force. Subsequent to this pre-coordination, SpaceX formally submits the STA application to the Commission's Office and Engineering and Technology, which then coordinates on our behalf with the National Telecommunications and Information Administration ("NTIA") and all other Federal users of the band. The applicant has very little insight into the interagency review process conducted through the Interdepartment Radio Advisory Committee ("IRAC"), and the outcome of the application is often unknown until very close to the launch date.

SpaceX concurs with the Commission's assessment that the STA process is suboptimal as commercial space launches and other commercial operations in orbit grow in volume and frequency. The Commission rightly notes that the current per-mission process creates significant business uncertainty, both in terms of approval prior to scheduled launch date, as well as with regard to the inherent uncertainty of non-interference status. Given the substantial financial and technical investment in each launch campaign— independent of customer in-orbit deadlines to realize material revenues to operate their businesses— SpaceX supports the Commission's stated intent of establishing co-primary, interference-protected allocation status for commercial space launch companies in order to streamline the authorization process through standard, clearly-defined application and coordination processes. Further, SpaceX strongly encourages the Commission to consider granting authorizations for multiple planned launches at a time— within the identified bands and frequencies proposed in the NPRM—rather than continuing with temporary authorizations on a case-by-case basis. Such an approach will materially reduce uncertainty in the licensing process for both the Federal and non-Federal users, enhance and expedite coordination, and enable long-range planning for all users.

A clear authorization process will help SpaceX and other commercial space launch operators continue to be responsible users of spectrum. To that end, SpaceX strongly supports the Commission's proposal to add non-Federal allocations to the three bands identified in the NPRM and allow licensees to operate in these bands on an interference-protected basis. Although coordination will always be required, the Commission's proposal with respect to specific portions of the 2200-2290 MHz band for launch telemetry will significantly reduce the amount of coordination that will be required and provides for predictable use for both Federal and non-Federal users.

III. SpaceX Responses to the Commission's Specific Inquiries and Proposals

The following comments reflect SpaceX's responses to each of the Commission's targeted questions in the NPRM.

- **Determination of Commercial Launch (Paragraph 45-46).** The Commission raises an important issue with respect to the whether the Commission or the NTIA will act as the prevailing federal agency as relates commercial space launch spectrum allocation. The Commission notes in the NPRM that the line distinguishing between commercial space launch operations and Federal involvement is often blurred given the equities involved. Consequently, the Commission specifically seeks comment on “how to determine whether a given launch is non-Federal or Federal for purposes of licensing spectrum for use during a launch.”¹²

The Commission poses as series of questions as to how to best identify a commercial launch, including the nature of the payload, the customer, and whether the launch occurs from a Federal range. None of these factors is conclusive, however. In order to create a bright-line standard, SpaceX recommends that the Commission make the determination as to whether a launch is commercial based *exclusively* on whether the FAA licenses the launch; this is the plainest mechanism by which to make a determination, is consistent with the National Space Policy and the Commercial Space Launch Act, and provides the most predictable regulatory standard for commercial operators and Federal users. The Commission rightly notes that it expects Federal agencies will increasingly rely on non-Federal launch services providers.¹³ Indeed, this is the case today as the cargo resupply missions by SpaceX and Orbital Sciences operate pursuant to contracts with NASA, yet the flights are deemed “commercial” and they are commercially licensed by the FAA. The same will likely be true for crew transportation flights, for which SpaceX’s Falcon 9 and United Launch Alliance’s (“ULA”) Atlas V are the potential launch vehicles.

- **Ability of Service Rules to Prevent Harmful Interference (Paragraph 47).** The Commission seeks comment on its assumptions as to whether in service rules that protect existing Federal equities while supporting the spectrum needs of the commercial space launch industry can be established if the Commission adopts co-primary allocations for commercial space launch in the 420-430 MHz, 2200-2290 MHz, and 5650-5925 MHz bands.¹⁴ SpaceX concurs with the Commission’s assumptions in this regard. First, the Commission rightly notes that coordination with NTIA will continue to be necessary to ensure that critical Department of Defense and other critical Federal Agency spectrum remains available. However, this coordination will be materially simplified and less burdensome should specific portions of the 2200-2290 MHz band be identified as the nominal frequencies for commercial space launch operations.

The Commission’s proposal limits non-Federal use to 2207-2219 MHz, 2270.5-2274.5 MHz, and 2285-2290 MHz. The Commission is correct in its assumption that the rate of launch operations from relatively few well-defined launch locations will essentially make request for spectrum during the duration of launch operations highly predictable. However, SpaceX notes that we are pursuing at least one additional launch site that will be off the Federal range, and that other providers may seek to do the same. As a result, the Commission’s proposal to limit the co-primary allocations in this band to launch testing and launches conducted at Federal Ranges will negatively impact the growth of the commercial space launch sector contrary to the stated

¹² NPRM at 39207-208.

¹³ NPRM at 39207.

¹⁴ NPRM at 39208.

intention of the NPRM. SpaceX recommends that the Commission limit launches and pre-launch testing conducted on Federal Ranges, FAA-licensed spaceports. Further, SpaceX strongly recommends the Commission allow non-Federal use of these bands to licensed commercial space launch providers for developmental testing, in addition to space launch operations.

- **Cost and Benefits of non-Federal Access to Proposed Bands (Paragraph 48).** With respect to the cost and benefits of providing non-Federal users with access to the bands raised in paragraph 48, the benefit to the commercial launch services provider is clear: it will streamline licensing, require less coordination, and provide greater certainty as relates to approvals. One of the largest challenges SpaceX currently has in this respect relates to our Avionics radiofrequency equipment being compatible with Western and Eastern Ranges, as well as having no certainty of authorization grants in the S-Band. The Commission's recommendation will generally alleviate cost burdens associated with radio frequency equipment and compatibility, since the proposed rule would allow predictable, co-primary access to the band for non-Federal users.
- **420-430 MHz Band Proposal (Paragraph 49-51).** For UHF, 420-430 MHz, SpaceX concurs with the Commission's assessment that non-interference access to this band is not currently required by commercial launch operators. As noted in the NPRM, the 420-430 MHz band is utilized for command and destruct signals in the event of an off-nominal launch; the signal is commanded by the U.S. Air Force Launch Range Safety. The Falcon 9 and Falcon Heavy launch vehicles do not radiate in this band, but only receive, and the frequency is determined by the Federal Launch Range and the spectrum allocation is currently authorized by NTIA for the Government user.

However, as the Commission notes, the onset of autonomous flight termination systems and the rise of fully commercial, FAA-licensed launch sites or spaceports will in the future require some new process. SpaceX's long-term plan is to qualify and fly an Autonomous Flight Termination System ("AFTS"), which would eliminate our dependency on the 420-430 MHz band. In the near term, SpaceX may seek frequency licenses from the Commission in order to utilize the 420-430MHz band at the company's McGregor, TX Rocket Development Facility or in New Mexico at Spaceport America (an FAA-licensed spaceport) to conduct additional R&D testing.

In addition, the Commission requests comment on whether it should make a co-primary non-Federal aeronautical mobile allocation for the 420-430 MHz band for use for self-destruct signals during commercial launches. SpaceX supports this proposal. For the domestic space launch industry to continue to grow, additional, off Federal Range launch capacity will be required to reduce manifest congestion and schedule bottle-necking. SpaceX is investing in such fully commercial launch infrastructure at this time; and FAA-licensed spaceports continue to proliferate in a manageable fashion. SpaceX supports the Commission's proposal to add a footnote to the Allocation Table restricting use of this non-Federal allocation to self-destruct signals during launches, but requests the Commission explicitly provide in the footnote for private spaceports or operators of commercial launch sites (including launch services companies who operate their own commercial launch sites) to request frequency authorizations for this purpose, rather than limiting the non-Federal allocation to launches conducted from Federal ranges.

- **Proposals Regarding 2200-2290 MHz Band (Paragraph 52-55).** The Commission seeks comment as to the preferred alternative with respect to the launch telemetry co-primary allocation in the 2200-2290 MHz band, either through an amendment to the Allocation Table or through a footnote to the Allocation Table specifying the portions of the band for launch telemetry. SpaceX supports the Commission's proposal to add a footnote to the Allocation Table rather than amend the Allocation Table to add a non-Federal Space Operations allocation to this band.

SpaceX understands that the addition of a footnote to the Allocation Table is legal equivalent of an amendment to the allocation. A footnote specifying the portions of the 2200-2290 MHz band which will be allocated to commercial space launch users on a predictable, interference-protected basis will achieve the greatest predictability and minimize coordination for use in these portions of the band.

SpaceX offers four recommendations to enhance the Commission's proposal and achieve the stated intent of supporting the robust growth of the domestic space launch industry:

- (1) non-Federal use must not be limited to launches from Federal ranges. This limitation would unduly limit the growth of the commercial space launch industry, as previously discussed, both from a launch operations perspective and from a developmental perspective. SpaceX appreciates that this is a Federal band. We recommend that non-Federal use be limited to launches originating from Federal ranges or FAA-licensed spaceports.
- (2) the footnote should provide that licensees may request spectrum for multiple planned launches simultaneously;
- (3) the footnote should add 4 additional MHz of bandwidth to support the operations of heavy lift launch vehicles, such as the Falcon Heavy, preferable expanding the 2207-2219 MHz portion of the band 2 MHz in both directions. The current portions of the band identified by the Commission are not sufficient to support Falcon Heavy radio frequency requirements;
- (4) the portions of the band identified should be approved for developmental testing using on a co-primary, interference-protected basis from FAA-licensed spaceports in addition to Federal Ranges to enable continued U.S. launch vehicle innovation.

SpaceX generally supports the Commission's proposal to limit the non-Federal use of these portions of the band for space launches and pre-launch testing, but as noted SpaceX strongly recommends the Commission add a provision enabling developmental testing on these bands to support next-generation U.S. launch vehicles. The forecasted growth of space launches and testing in the United States justifies these limitations; further, the limitation will enhance the coordination process and achieve the Commission's goal to streamline the licensing process.

The Commission inquires as to whether there is sufficient spectrum in this band given heavy use by Federal agencies. Although this is a question best posed to Government users, SpaceX believes the discrete portions of the 2200-2290 MHz band proposed for co-primary space launch allocation by addition of a footnote to the Allocation Table (i.e. 2207-2219 MHz, 2270.5-2274.5

MHz, and 2285-2290 MHz) best addresses any risk of interference with Federal users. Subject to SpaceX's above recommendation to add 4 additional MHz of bandwidth to these discrete portions, launch services providers should have sufficient capacity within these portions of the band and should be able to perform simultaneous launches with the same frequencies without causing harmful interference to Federal or non-Federal users. For most launch vehicle missions, ground systems typically utilize an antenna pointed at the launch vehicles to receive the signal. In the unlikely event of two simultaneous launch vehicles flying requiring spectrum, the different trajectories involved and the physical separation of launch sites (e.g. Cape Canaveral Air Force Station and Wallops Island in Virginia), the missions would be able to occur on the same frequency on different trajectories without interference. Interference with Federal users is highly unlikely. Indeed, launch telemetry is currently allocated on these frequencies and approvals have occurred following coordination, indicating that the portions of the 2200-2290 MHz bands identified by the Commission are appropriate.

However, SpaceX notes that the portions of the 2200-2290 MHz band are sufficient to support the needs of the Falcon 9 launch vehicle; they are insufficient to support upcoming launches of the Falcon Heavy launch vehicle. Consequently, SpaceX strongly recommends the Commission add 4 MHz of bandwidth in one of the identified portions of the band, preferably 2207-2219 MHz. SpaceX is developing the Falcon Heavy specifically to support Defense Department launch requirements under the U.S. Air Force Evolved Expendable Launch Vehicle ("EELV") Program, as well as to support commercial market needs for heavy communications satellites. Falcon Heavy will not only support critical national security missions and further enhance the Nation's competitiveness in the global space launch marketplace, but it will allow for far-reaching exploration of the solar system. To enable timely approval of radio frequency licensing for Falcon Heavy missions, SpaceX respectfully request the Commission expand the portions of the band it has identified for co-primary allocation.

As the Commission notes, allocating the same frequencies for Federal and non-Federal launches is advantageous from a cost and infrastructure perspective. SpaceX's experience in radio design work accomplished to date demonstrates the difficulty of making a radio work across both the federal band and the commercial band. It is also particularly difficult to make antennas work across both bands and maintain optimal performance. As a result, we concur with the Commission's proposal to allow commercial users to utilize the same frequencies for both Federal and non-Federal space launch operations.

- **Proposals Regarding 2310-2390 MHz Band (Paragraph 56-58).** The Commission inquires as to whether it should, as an alternative to the allocating portions of the 2200-2290 MHz band, utilize three frequencies in the 2360-2396 MHz band for commercial space launch operations.

SpaceX does not support this approach. First, as the Commission has noted, there are material cost and infrastructure efficiencies achieved in utilizing the same band (2200-2290 MHz) for both Federal and non-Federal launches, rather than requiring radios be compatible for two different bands depending on the launch customers (e.g. government or commercial). Second, there major impediments to allocating 2310-2390 MHz relating to ground equipment, which currently supports the 2200-2290 MHz band for space launch operations. Currently, there is a wide variety of support equipment available (ground antennas, radios, etc.) that are made for the 2200-2290 MHz band. If commercial operators were required to utilize a different frequency band (such as

2310-2390 MHz), their support options would be substantially limited, they would lose access to existing stations, and they would be required to seek out specialized equipment that has the same functionality but supports a different band, substantially raising ground costs. Third, SpaceX currently uses the 2200-2300 band for Range communication; shifting the frequencies at this time would add requirements for the Range, which are facing significant fiscal challenges on instrumentation. Finally, SpaceX has no insight into current usage of this band for aeronautical telemetry for flight testing, and therefore cannot gauge the sufficiency of the spectrum. Coordination with such entities would add uncertainty to the frequency authorization process and undermine the Commission's stated goals for this rulemaking.

- **Proposals Regarding the 5650-5925 MHz Band (Paragraph 58).** Currently, the C-Band (5650-5925) is mostly utilized for radar transponder for range tracking of the launch vehicle, and is requested by Federal users by the Federal range. SpaceX's understanding is that coordination on this band for this purpose has not been difficult. Eventually, SpaceX intends to move toward AFTS, which would obviate any need for the 5 GHz C-band for launch operations.

IV. Other Considerations

Orbital Debris Mitigation Requirements

Although the Commission's NPRM as published in the *Federal Register* does not mention the matter of third party liability (TPL) coverage or orbital debris mitigation requirements, the issue was identified in the Commission's proposal at the time it was approved by the Commissioners on May 9, 2013. In that publication, the Commission notes that, with regard to communication involving satellites, it has "required applicants to provide additional information, such as design and operational strategies for mitigating orbital debris."¹⁵ The Commission further notes, however, that for the purpose of this NPRM, "scope is limited to spectrum used during launches."

SpaceX appreciates the limitation in scope of the current rulemaking but hopes to further clarify the Commission's process with respect to TPL coverage and orbital debris mitigation in the course of authorizing radio frequency licenses for commercial space launches. To the extent that the Commission develops in service rules following this rulemaking, SpaceX strongly encourages the Commission to continue its existing practice of deferring to the FAA with respect to orbital debris matters. Specifically, the Commission recently noted in official guidance to the commercial space launch industry that "applicants need not submit orbital debris mitigation information to the FCC in connection with launch, cargo delivery, or re-entry activities that will be reviewed or approved through FAA and NASA processes."¹⁶ This practice should be carried forward under in process rules relating to commercial space launch providers.

Further, as the FCC has acknowledged in its Second Report and Order, Released June 21 2004, In the Matter of Orbital Debris Mitigation, IB Docket No. 02-54, FCC 04-130 ("Second Report and Order"): "To the extent that the debris mitigation disclosure certifies that the debris mitigation plans of the launch

¹⁵ Federal Communications Commission. Second Report and Order, In the Matter of Orbital Debris Mitigation, IB Docket No. 02-54, FCC 04-130. June 21, 2004.

¹⁶ Federal Communications Commission. Public Notice DA: 13-446. March 15, 2013.

vehicle upper stage have been, or will be, reviewed by the FAA, no further FCC examination of the debris mitigation plans of the upper stage will be required.” SpaceX notes that the FAA is specifically and directly charged with examining TPL issues as part of its explicit statutory authority related to the launch and reentry of commercial launches. In particular, the FAA Office of Commercial Space Transportation is empowered by the Commercial Space Launch Act to license the launch and reentry of all commercial launches. SpaceX recommends the Commission continue the practice as outlined in the Second Report and Order in order to avoid duplicative regulatory requirements.

V. Conclusion

SpaceX appreciates the opportunity to provide comment on the Commission’s proposed rulemaking. SpaceX appreciates the Commission’s focus on creating a stable, predictable, and streamlined regulatory approach for the authorization of spectrum for commercial space launch operations. We look forward to continuing to work with the Commission on this and related matters.

Respectfully Submitted,



Timothy R. Hughes
Senior Vice President & General Counsel